



Epidemiology of anthroponotic cutaneous leishmaniasis in Afghan refugee camps in northwest Pakistan

Jan Kolaczinski^{a,b,*}, Simon Brooker^b, Hugh Reyburn^b, Mark Rowland^b

^a HealthNet International, University Town, P.O. Box 889, Peshawar, Pakistan

^b Disease Control and Vector Biology Unit, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK

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Summary During November and December 1998, 16 Afghan refugee camps were surveyed for anthroponotic cutaneous leishmaniasis (ACL). Prevalence of active lesions and scars amongst the population was 2.7% and 2.4%, respectively. Between camps the prevalence of active lesions varied from 0.3 to 8.8% and that of scars from 0.3 to 5.8%. Random-effects logistic regression indicated that risk of active ACL was associated with age but not gender. This model also indicated a significant clustering at the household level. The average annual force of ACL infection was estimated to be 0.046 per year (4.6 cases/1000 persons/year) over the past 10 years. Based on the evidence from this study an intervention strategy was formulated for all camps with reported ACL cases. This includes targeting of active cases with insecticide-treated nets, sold at a highly subsidised price.

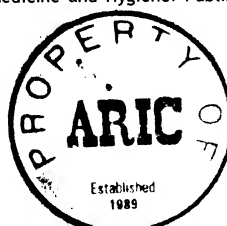
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1. Introduction

The global epidemiology of leishmaniasis has been changing, with the emergence or re-emergence of the disease in many parts of the world: a change variously ascribed to population movement and man-made environmental change (Desjeux, 2001). Three species of leishmaniasis are endemic to Pakistan. Visceral leishmaniasis due to *Leishmania infantum* occurs sporadically in the Northern Areas, Azad Kashmir, and neighbouring parts of the North West Frontier Province (NWFP) and Punjab (Ahmed and Burney, 1962; Rab et al., 1989). Zoonotic cu-

taneous leishmaniasis due to *L. major* is endemic to the southwest, mainly occurring in Balochistan and neighbouring Punjab and Sindh provinces (Burney and Lari, 1986; Rab et al., 1986). Anthroponotic cutaneous leishmaniasis (ACL), caused by *L. tropica* and transmitted by the sandfly vector *Phlebotomus sergenti*, has the widest distribution, occurring in urban areas of southern Punjab (Multan) and Balochistan (Quetta), but also focally in the Northern Areas and Azad Kashmir (Burney and Lari, 1986; Massoom and Marri, 1993). Cases of ACL are being increasingly reported from towns of NWFP and Balochistan (Rab, 1994). In 1997, a large outbreak of ACL was reported from Timargara refugee camp in NWFP (Rowland et al., 1999). Survey results showed that 38% of the camp population was affected during the outbreak,

*Corresponding author. Tel.: +92-91-844474;
fax: +92-91-840379.
E-mail address: jan.kolaczinski@lshtm.ac.uk (J. Kolaczinski).



compared with 17% in the previous year, suggesting that the outbreak had originated within the camp. *Leishmania tropica* was confirmed by PCR as being the cause of the ACL outbreak (Rowland et al., 1999). Zoonotic cutaneous leishmaniasis (*L. major*) seems to be unlikely both from a description of the lesions and the known distribution of the disease and rodent reservoirs (Masoom and Marri, 1993). Additional reports of ACL were received from basic health units (BHUs) serving other camps in the same province, raising concern as to the spread of the disease both in the refugee camps and in the neighbouring Pakistani villages. This concern is supported by the widespread presence of the sandfly vector *P. sergenti* in Pakistan (Lewis, 1967; Nasir, 1964). To investigate this issue and to guide interventions, the United Nations High Commissioner for Refugees (UNHCR) commis-

sioned a study in an additional 16 Afghan refugee camps. The results of this study are reported here.

2. Materials and methods

2.1. Study area and surveys

The NWFP hosts more than one million Afghan refugees. Originally arriving more than 20 years ago, the refugees inhabit over 200 camps constructed on marginal land in most districts and agencies of the province, from Chitral in the far north to Waziristan in the southwestern tribal areas and Mansehra in the east (Figure 1). The environment varies from mountain valleys in Chitral, to high plateaux in Waziristan and hot flood plains in the centre.

In 1998, cases of ACL were reported from refugee camps across the length and breadth of



Figure 1 Districts of the North West Frontier Province (NWFP) and location of the province within Pakistan. Shaded areas on larger map represent Federally Administered Tribal Areas (FATA).

the province. Between November and December, a house-to-house questionnaire survey was conducted in 62 clusters of 16 camps where ACL had been reported by health care providers during the year. The age, gender and presence of current or past infection, previous area of residency and years in the camps were recorded for all people in the household. Wherever possible, reported lesions were inspected to confirm their consistency with the symptoms of ACL.

Several camps in Kurram and Kohat districts were revisited to obtain travel histories and to confirm the diagnosis by means of parasitological examinations of samples of active cases. Smears were taken from nodular margins of lesions using a scalpel, fixed in methanol, stained with Giemsa's solution, and examined using light microscopy.

2.2. Analysis

The effect of age, gender and length of residency was investigated using a random effects model fitted to the logistic regression, to account for the non-independence of individuals within a single household. This model provides estimates of regression coefficients and a measure of within-household clustering, termed ρ , which estimates the proportion of total variance accounted for by the random effect. A ρ of zero indicates no clustering of cases within households. The null hypothesis for this test is $\rho = 0$ and a likelihood ratio test is used to test significance. This analysis was carried out using the

xtlogit command in Stata 6.0 (Stata Corp., College Station, TX, USA).

3. Results

A total of 19918 individuals from 3461 families in 1712 households was surveyed. Most of the families (43.7%) stated that they had lived in the refugee camps for 20 years; a total of 90.4% had lived in the camps for 10 years or more. Most of the refugees surveyed had originated from Afghanistan's eastern provinces of Paktia (33.2%), Logar (13.8%), and from Kabul (9.8%).

Prevalence of active lesions and scars amongst the population sampled was 2.7% and 2.4%, respectively. Prevalence showed no clear regional trend across the province. Between camps the prevalence of active lesions varied from 0.3 to 8.8% and that of scars from 0.3 to 5.8% (Table 1). Prevalence varied greatly between clusters within camps; maximum variation for active lesions (0 to 18.2%) was reported from Khair Abad in Chitral.

Prevalence of active lesions and scars by age group is shown in Figure 2. The prevalence of active lesions increased dramatically with age up to 15 years then showed a decline until 25 years, after which prevalence levelled out. A similar pattern was observed for scar prevalence. The average annual force of ACL infection was estimated, using maximum likelihood methods (Williams and Dye, 1994), to be 0.046 per year (4.6 cases/1000 persons/year) over the past 10 years.

Table 1 Prevalence of anthroponotic cutaneous leishmaniasis in 16 Afghan refugee camps in North West Frontier Province, Pakistan

Camp	District or Tribal Agency	Total population	Population surveyed	Active lesion (%)	Scar (%)
Domshoghor	Chitral	1600	806	4 (0.5)	30 (5.2)
Khair Abad	Chitral	1300	1033	91 (8.8)	43 (5.8)
Burary	Mansehra	9599	1758	15 (0.9)	25 (1.4)
Sheikh Abad	Mansehra	7315	1574	54 (3.4)	18 (1.1)
Ichrian	Mansehra	12 390	933	28 (3.0)	18 (1.9)
Dargamandi	North Waziristan	14 200	956	18 (1.9)	22 (2.3)
Match Factory	North Waziristan	26 000	2095	23 (1.1)	20 (1.0)
Darpakhil	North Waziristan	18 000	717	12 (1.7)	27 (3.8)
Kotki	Kohat	7588	1082	10 (0.9)	3 (0.3)
Lakhtibanda	Kohat	12 863	1528	14 (0.9)	11 (0.7)
Katakani	Kohat	8164	1171	28 (2.4)	19 (1.6)
Kai	Kohat	12 229	1244	56 (4.5)	61 (4.9)
Surpol	Kurram	1500	1145	70 (6.1)	53 (4.6)
Bagzai	Kurram	16 000	2233	94 (4.2)	86 (3.9)
Gambila	Bannu	13 000	674	11 (1.6)	9 (1.3)
Wocha Khawr	South Waziristan	7111	969	3 (0.3)	23 (2.4)
Total		168 859	19918	531 (2.7)	468 (2.4)

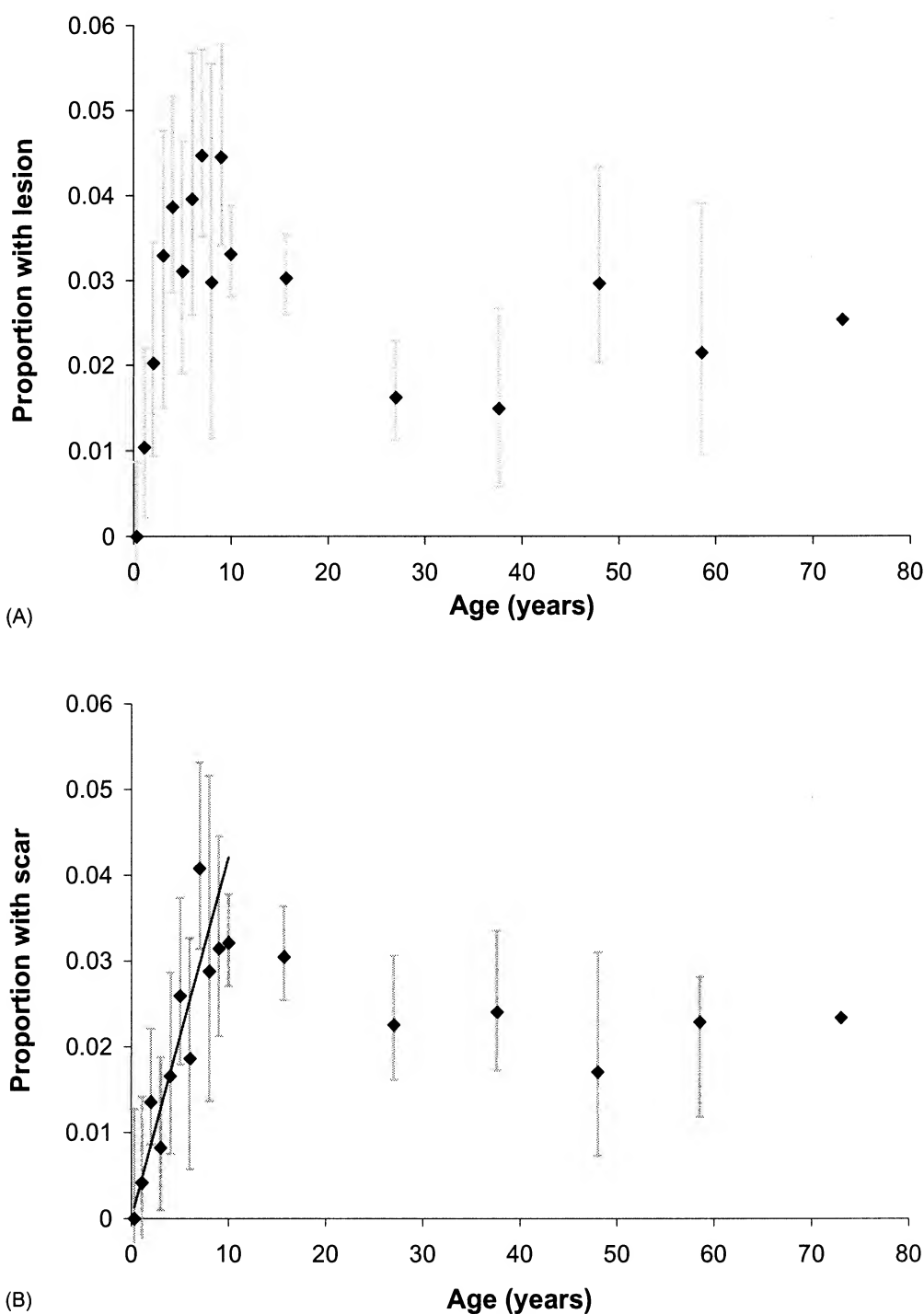


Figure 2 (A) Prevalence of active cutaneous leishmaniasis and (B) cutaneous leishmaniasis scars, by age among 19918 individuals living in 16 Afghan refugee camps in North West Frontier Province, Pakistan. The first 20 years of age are plotted individually; age groups above 20 years of age are shown in 10 year intervals. Solid line indicates fitted estimate of force of infection. Error bars represent binomial 95% CIs.

The random effects model that accounted for household correlation showed that age, but not gender or length of residency, was associated with the risk of active ACL (Table 2). No significant interaction was observed between any of the variables.

This analysis also indicated significant household clustering of infection: the household effect accounted for 0.52 of the total variance ($P < 0.001$).

Of the 91 slides taken during the second survey, 60% were positive for CL by microscopy. Evidence

Table 2 Random-effects odds ratio estimates from logistic models for active anthroponotic cutaneous leishmaniasis in Afghan refugee camps in Pakistan, 1998

Factors	Odds ratio (95% CI)	P
Age	0.99 (0.98–0.99)	0.001
Gender	1.01 (0.85–1.21)	0.870
Length of residency	0.97 (0.94–1.01)	0.138

Estimate of $\rho = 0.52$, $P < 0.0001$, 95% CI 0.46–0.57.

for local transmission was strong. Of the 309 cases interviewed, 77% had been born in Pakistan, 83% had never been to Afghanistan, and only 1.8% reported travelling to Afghanistan within the period that transmission of their disease would have been possible.

4. Discussion

Our current findings indicate that ACL is widespread in refugee camps in Pakistan, although at lower prevalence than those reported by Rowland et al. (1999). The intensity of transmission, as estimated by the force of infection (λ), is lower than that estimated for Kabul, Afghanistan, where λ was estimated to be 29 cases/1000 persons/year (Reithinger et al., 2003). While some cases in the refugee villages will have been imported from Afghanistan, our evidence points to local transmission as being the main cause of ACL among refugees. The sandfly vector, *P. sergenti*, was found during an entomological survey of Khair Abad refugee village in 1998 (HealthNet International, unpublished data) and this species is widely distributed in Pakistan (Lewis, 1967; Nasir, 1964).

The results of the random effects model indicated significant household clustering of ACL, indicative of highly focal transmission. This conclusion is supported by the significant household clustering of infection found in Kabul (Reithinger et al., 2003) and the small scale (300 m) spatial clustering of visceral leishmaniasis in Teresina, Brazil (Werneck et al., 2002). Clustering within certain families may arise due to a variety of factors including heterogeneity to exposure (due to entomological, environmental or behavioural factors) or differences in susceptibility to infection (due to genetic or immunological factors). Werneck et al. (2002) suggested that transmission in a Brazilian population was limited to areas corresponding to the short flight range of sandflies and the reservoir distributions. Further investigation is warranted to examine the relative

contributions of entomological, environmental, immunological, and genetic factors in susceptibility to infection.

In response to the present findings, interventions for the control of ACL in Afghan refugee camps throughout NWFP, Punjab and Balochistan have been stepped up over the years. Staff at BHUs were trained to provide the skills needed for reliable diagnosis and treatment. Pentavalent antimonial drugs, until 2002 not registered in Pakistan, were procured and donated by UNHCR. An insecticide-treated bednet (ITN) programme was initiated in 2000, providing nets and insecticide at highly subsidised prices to ACL patients in refugee camps with reported cases.

Present concern for ACL control efforts in Afghan refugee camps originates from the large proportion of local residents from villages adjacent to refugee camps that is regularly diagnosed and treated at BHUs in refugee camps. This results from the high level of care provided at these facilities and the general absence of treatment for ACL in local health facilities. Between January and June 2003, 35% of patients treated at BHUs were non-camp, local population. This population provides a continuing reservoir for transmission, and will need to be targeted to ensure sustained control in the future.

The present study highlights the importance of ACL among Afghan refugee populations and forms the basis for targeting control efforts. Further study is required to investigate transmission of ACL throughout refugee camps in NWFP, Balochistan and Punjab and its prevalence in the local population.

5. Ethical clearance

Ethical approval for the study was obtained from the Pakistan Ministry of Health.

Conflicts of interest statement

The authors have no conflicts of interest concerning the work reported in this paper.

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